

AMD Projects

Innovate • Transform • Protect

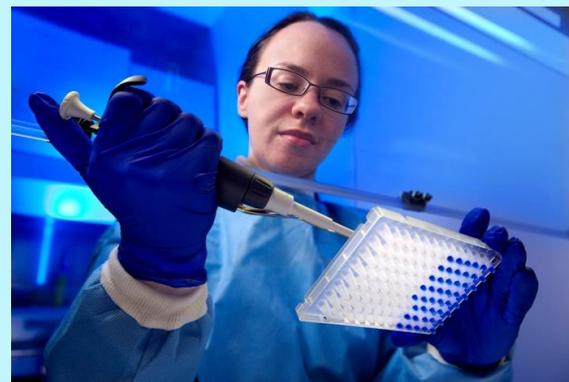
CDC's Advanced Molecular Detection (AMD) initiative fosters scientific innovation in genomic sequencing, epidemiology, and bioinformatics to transform public health and protect people from disease threats.

AMD Projects: Finding the Needle in the Haystack

Using Metagenomics to Diagnose Infections and Control Disease Outbreaks

As CDC faces the challenge posed by emerging infectious diseases, days or weeks spent finding the cause of a cluster of new illnesses could mean the difference between containing a small outbreak or seeing a few cases erupt into a full blown epidemic. Compounding this challenge, new molecular tests have the potential to eliminate the need to isolate and grow pathogens from patient samples (e.g., blood, stool, urine, etc.). By decreasing the isolates shared among public health partners, these new tests can hinder disease tracking. Fortunately, CDC is also investigating new diagnostic tools.

Metagenomics is one of the promising methods CDC is using to detect and track infectious agents. Metagenomics allows sequencing of everything in a patient sample, including normal cells. Then scientists use powerful computer programs to identify any sequences we wouldn't expect to see in that



Using metagenomics, researchers can sequence everything in a patient's sample and amplify the pathogens without the need to isolate and grow them first.



type of sample. This way, there will likely come a day when we can pick out the infectious pathogen in the midst of sample and see all of its genetic characteristics, such as whether it is resistant to antimicrobials, in one step without first identifying, extracting, and growing it in a culture, which will save time in the diagnostic process. Because this method facilitates sequencing all unique DNA in a sample, metagenomics has the potential to speed up identification and characterization of unsuspected pathogens or even pathogens that have never before been encountered.

The AMD Metagenomics Work Group (MWG) aims to develop methods that allow for rapid pathogen characterization without the need for culture, as well as explore and understand the greater role of the whole microbiome in healthy and diseased individuals.



2016 Update

In its first two years, the AMD MWG team has worked on developing tools that will enrich genetic material for pathogens in clinical samples. These techniques utilize the most cutting edge approaches available and some newer technologies still in development to identify and characterize the pathogen community from clinical samples while also characterizing the entire microbial community of a clinical or environmental sample. Thus far, project researchers have constructed simulated clinical samples containing varying degrees of infectious agent DNA, which are used as a reference point for developing and evaluating the performance of advanced technologies. Using these simulated clinical samples, researchers have evaluated and demonstrated methods for targeted enrichment of Shiga toxin-producing *E. coli*, tuberculosis, and influenza that allow for pathogen characterization up to 30 days sooner than some traditional methods. Researches also used simulated reference materials to evaluate optimal approaches for finding pathogens from small or suboptimal clinical samples.